A DAY BY THE BUFFALO

KARST TOPOGRAPHY AND CAVES – The Underground Classroom

Buffalo National River protects many different types of habitat, harboring a wide diversity of species, including those found underground.

TEACHER BACKGROUND

Karst systems are a type of topography that is formed upon or in contact with rock units of limestone and dolomite. These units are formed, most typically, by the dissolution of calcium carbonate by water as it percolates down from the surface into the cracks and fissures of the rock unit layers.

Karst systems in the Buffalo River drainage are associated with the Boone Formation. The Boone Formation is composed of limestone of the Mississippian age, and has intermittent chert layers near the top and bottom of the formation. Typically, most of the larger cave systems are found in and near the upper and lower contacts of the Boone. However, some cave systems have passages that go into the upper (Mississippian and Pennsylvanian) and lower (Ordovician) stratigraphic layers.

Although karst can take many forms, springs, sinkholes, and caves characterize the Ozarks of Northwest Arkansas. Ocean waters covered all of Arkansas during the Paleozoic Era, about 300 million years ago. When sea creatures in this ancient ocean died, their shells fell to the ocean floor. Layer after layer of these shells were pressed together over time, eventually forming horizontal layers of sedimentary rocks known as limestone and dolomite. The horizontal layers of limestone and dolomite are visible along river bluffs and highway cuts.

Karst features are formed when slightly acidic rainwater reacts with limestone and dolomite and slowly dissolves the rock. Rainwater contains dissolved carbon dioxide creating a weak carbonic acid as well as organic acids produced by decaying leaves and other organic material from the surface of the land. Although limestone is not particularly permeable to water, large cracks in the limestone bedrock allow water to move extensively underground. As this groundwater comes in contact with limestone, the water dissolves the rock, widening the cracks to form underground passages and, eventually, caves.

The Buffalo National River has over 300 cave systems within its boundary – about 10% of the known caves in Arkansas, and many of these systems are unique to the area. The Ozark Mountains are known to have one of the largest karst networks in the mid-west United States. Caves provide a habitat for many unusual species, including bats, a variety of cave invertebrates, salamanders and blind cavefish. All of these organisms are characterized by adaptations that suit them for life in a dark, cool subterranean habitat.

CLASSROOM: PRE-VISIT ACTIVITY

ACTIVITY – FILTER FACTS

STATE STANDARD
Science – Strand 4: Earth and Space Science
Standard 8. Earth Science: Structure and Properties
Students shall demonstrate and apply knowledge of Earth's structure and properties using appropriate safety procedures, equipment, and technology.

OBJECTIVES
Students will:
1. explain how soil and vegetation help to filter water
2. describe karst topography and explain how water travels through it.

MATERIALS
- two capped clear plastic liter bottles that have bottoms removed and a small hole punched into the caps
    - fill bottle **A** with mostly rocks below and a shallow layer of soil on top
    - fill bottle **B** with alternating layers of rock, soil, and vegetation material (twigs, leaves, grass, etc.)
- one additional container filled with visibly **DIRTY** water to pour in bottles **A** & **B**
- two empty containers to catch the dirty water as it leaves bottles **A** & **B**

ACTIVITY
1. Ask for volunteers to hold bottles **A** and **B** side-by-side for the rest of the class to see. Ask for two other volunteers to hold the clean, empty containers under each bottle.

2. Pour the **DIRTY** water into bottle **A** while a volunteer catches water in a clean container. Observe the results and record.

3. Now pour the **DIRTY** water into bottle **B** while a volunteer catches water in a clean container. Observe the results and record.

Suggested questions for discussion after demonstration:
1. Was there any difference in the water after it flowed through the bottles?
2. Which was the cleanest and why?
3. Discuss Karst topography
4. Discuss importance of vegetation such as trees, leaves, plants, forest organic litter and soil on the filtering process.
5. Do you suppose the vegetation cover makes much of a difference in the water quality of a watershed?
6. What effect does Karst topography have on water quality?
7. If you discharge dirty water through a karst system, what might you expect to find as a result in area springs and seeps?

NATIONAL RIVER: ON-SITE ACTIVITY

ACTIVITY: SILVER HILL CAVE – THE UNDERGROUND CLASSROOM

STATE STANDARD
Science - Strand 2: Life Science
Standard 4 Populations and Ecosystems
Students shall demonstrate and apply knowledge of populations and ecosystems using appropriate safety procedures, equipment, and technology.
Strand 4 Earth and Space Science
Standard 8 Earth Systems: Structure and Properties
Students shall demonstrate and apply knowledge of Earth's structure and properties using appropriate safety procedures, equipment, and technology.

OBJECTIVES
Students will:
1. be able to define troglobite and identify 3 troglobite or troglophile species
2. explain how caves form
3. know the "Caver's Motto"

MATERIALS
- day pack with water
- sturdy closed-toe shoes, no sandals or flip flops
- long pants
- helmets, lights and gloves are provided
- change of clothes for other activities, you will get dirty in cave

ACTIVITY
Be prepared to spend approximately one hour with a park ranger hiking cross-country and crawling into a cave. Group will experience a crawl-in cave entrance which opens into a large room. Leader will discuss cave etiquette, help students discover cave fauna, explain karst topography and cave formation, and ensure caving safety and cave protection.

CLASSROOM: POST-VISIT ACTIVITY

ACTIVITY 1. – CAVE-CICLES

STATE STANDARD
Science
Strand 4 Earth and Space Science
Standard 8 Earth Systems: Structure and Properties
Students shall demonstrate and apply knowledge of Earth's structure and properties using appropriate safety procedures, equipment, and technology.

OBJECTIVES
Students will:
1. be able to explain how cave formations grow
2. explain why it is necessary to be careful of cave formations

MATERIALS
- 2 cups
- Epsom salts
- cotton or wool string
- 2 nails
- cardboard

ACTIVITY
Dissolve Epsom salts in hot water in each cup until no more will dissolve. Soak the string in one cup then tie a nail to each end of the string. Put one nail in each cup and place the cups on either side of the cardboard. The string should not be stretched tight, but don't allow it to touch the cardboard. Leave the experiment in a safe place and observe the growth of your stalactites and stalagmites.

DISCUSSION
How long did it take to grow your cave-cicles? Are they easily damaged or destroyed? How does this compare to the formations in caves?

ACTIVITY - 2. FIZZY ROCKS

OBJECTIVES
Students will:
1. be able to demonstrate how caves form

MATERIALS
- rocks
- vinegar or lemon juice

ACTIVITY
Have students gather a selection of rocks from around the school grounds. Use an eyedropper to put 1 drop of solution on a rock. Is there a reaction? If the rock is limestone or contains a carbonate compound, the solution will bubble a little.

DISCUSSION
Why do some rocks fizz and some don't? How does nature make a weak acid like vinegar that erodes the rocks to make caves?

KEY WORDS
national parks, protection, Ozarks, cave, sinkhole, erosion, ecology, environment, tributary, polluted, karst topography, biological environment, preserving, communities, sedimentary rocks, limestone, dolomite

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